Chetan Reddy N

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Education

Indian Institute of Technology Madras *Aug 2019 - May 2024*
Bachelors (B.Tech) in Mechanical Engg, Masters (M.Tech) in Data Science | ***CGPA: 9.38/10*** | ***Department Rank: 3/41***

KTH Royal Institute of Technology, Stockholm, Sweden *Aug 2022 - Jan 2023*
Semester Exchange | *School of Electrical Engineering and Computer Science* | ***GPA: 5.0/5.0***

Scholastic Achievements

- Among the **top 3 out of 50+ interns** nationwide to secure a pre-placement job offer at Adobe Research. *2023*
- **One of the 7 students selected from India** for an in person fully funded internship at Hokkaido University, Japan *2022*
- Recipient of the **¥ 160,000** JASSO Scholarship awarded by the **Government of Japan**. *2022*
- Awarded the **Prestigious Summer Research Fellowship 2022** by the three National Academies of Sciences. *2022*
- **Ranked 3rd** in a NPTEL MOOC course on **Data Structures and Algorithms**, enrolled by 25,000+ students. *2021*
- Secured an **All India Rank 957** in JEE (Mains) 2019 out of **1 million candidates** across the country. *2019*
- Secured an **All India Rank 931** in JEE (Advanced) 2019 out of 150,000 shortlisted candidates. *2019*
- Achieved a **State Rank of 15** in Karnataka Common Entrance Test 2019 written by about **200,000 students.** *2019*

Research Experience

Human in the Loop, Safe and Verifiable Reinforcement Learning (RL) | IIT Madras Chennai, India
Dual Degree Thesis | *Guides: Prof. Nirav Bhatt and Prof. Balaraman Ravindran* *Aug 2023 - Present*

- Working on developing a framework to formulate safe RL problems with human guidance, to improve sample efficiency.
- Modified the DDPG algorithm to enable **action masking in continuous spaces** by leveraging a human-provided safe set.
- Attained an average angle of 5° in the inverted pendulum environment while ensuring 100% safety in training.

Safety Critical Navigation using Depth Information | KTH Royal Institute of Technology Stockholm, Sweden
Graduate Research Collaborator | *Guide: Prof. Jana Tumova* *Jan 2023 - Present*

- Developed control strategies to achieve obstacle avoidance with provable safety guarantees in an **unknown and stochastic environment** by using **control barrier functions (CBFs).**
- Defined **new notions of safesets** that can be obtained from the noisy depth images to construct the CBFs.
- Implemented the algorithm in simulation using **ROS** with a turtlebot equipped with an Intel RealSense RGB-D camera.

Use of Deep Reinforcement Learning in Autonomous Cars | Hokkaido University Sapporo, Japan
Research Intern | *Guide: Prof. Hidenori Kawamura* *May 2022 - Jul 2022*

- Investigated the use of RL to optimise traffic flow in scenarios like highway merge and intersection crossings.
- Implemented the Dueling Double DQN Algorithm and tested it with different state space encodings to represent the traffic.
- RL-based autonomous cars **reduced the average congestion clearance time by 30%** relative to rule-based agents.

Work Experience

Targetable Causal AI: Discovering Heterogeneous Causal Relations | Adobe Research Bengaluru, India
Summer Research Intern | *Guide: Dr. Atanu R Sinha* | ***Patent under internal review at Adobe** *May 2023 - Aug 2023*

- Examined the role of unobserved heterogeneity in estimating causal effects of actions to improve targeting decisions.
- Researched and implemented different algorithms for **causal inference like PC, FGES, FCI and LINGAM.**
- Achieved **robust market clustering** by developing a novel algorithm combining DL with causal structure discovery.
- **Identified and analyzed metrics** for evaluating the causal models implemented on **real and observational data**.

Clickbait Analysis of News Sites | Digital Outcomes Mumbai, India
Machine Learning Intern | *Guide: Pranav Shah* *May 2021 - Jun 2021*

- Worked on applying advanced ML techniques to identify whether a news headline is clickbait or not.
- Developed a **web scraping tool** to gather data from news websites and collected around **100,000 data points**.
- Built **SVM and decision tree models with TF-IDF embedding** and achieved an F1 score of 0.91 and 0.88.
- Achieved a higher F1 score of 0.94 using a transfer learning model with **BERT implemented in TensorFlow**.

Key Courses

*Courses in KTH

- **Robotics**: Introduction to Robotics* | Safe Robot Planning and Control* | Control Systems | Automation in Manufacturing
- **AI/ML**: Reinforcement Learning| Pattern Recognition and Machine Learning | Data Analytics Lab | Big Data Lab
- **Mathematics**: Multivariable Calculus| Probability, Statistics and Stochastic Processes | Linear Algebra | Differential Equations
- **Computer Science**: Data Structures and Algorithms using Python | Design and Analysis of Algorithms

Skills

- **Programming Languages**: C, C++, Python (NumPy, Pandas, PyTorch, TensorFlow, OpenCV, Matplotlib, Seaborn, Rospy)
- **Tools**: Robot Operating System (ROS), MATLAB, Fusion 360, Git, LaTeX, Linux, Google Cloud Platform (GCP)

Key Projects

Drone Swarm Challenge | Inter IIT Tech Meet 2023 - IIT Kanpur Dec 2022 - Feb 2023

Developed a vision-based centralised controller to communicate with and control drones to move in a coordinated manner.

- Achieved stable hovering and vision-guided rectangular motion of drones by implementing a **multi-axis PID controller**.
- Developed a **Telnet interface for swarm communication** and a PID class for simultaneous control of multiple UAVs.
- Transformed the existing ROS-based communication framework into a python script making it **platform-independent.**
- Designed a post-flight analytics dashboard to assess and tune the algorithm using React.js and Plotly.

Competitive Multi-Agent Reinforcement Learning | RL Games Hackathon | Shaastra 2022 Dec 2021 - Jan 2022

Created bots using reinforcement learning to compete with other bots in a virtual two-player 2D game setting.

- **Winner of the competition** with over **700 participants across India** and earned a cash prize of Rs.10,000.
- Implemented two deep reinforcement learning models in **Pytorch** namely Policy Gradients and Deep Q Learning.
- Crafted a **novel feature engineering technique** inspired by the decision tree algorithm, doubling the average score earned.

Mission Planner for Autonomous Robots | Course Project - Introduction to Robotics Aug 2022 - Dec 2022

Course Project for the introductory course to the Masters in Robotics Program at KTH Royal Institute of Technology, Sweden

- Implemented **Inverse Kinematics solution** for a 7 DOF robotic arm using its Denavit-Hartenberg parameterization.
- Coded **A* and Rapidly Exploring Random Tree (RRT)** algorithms from scratch for a bot following dubin's car dynamics.
- Achieved autonomous navigation and manipulation based on high level instructions by building a **mission planner for the TIAGo robot in ROS using behaviour trees**.

Wells Fargo Quantitative AI Hackathon | Shaastra 2022 Dec 2021 - Jan 2022

Forecasted the implied volatility surface of options over 60 trading days using 2.5 years of past volatility surface data.

- Secured **3rd place out of 500+ teams** registered across the country in the national-level quantitative AI hackathon.
- Attained an RMS error of 0.033 based on a univariate approach using ARIMA (Autoregressive Integrated Moving Average).
- Further implemented an **autoencoder decoder LSTM network** which decreased the RMS error by 15%.

Extra-Terrestrial Manufacturing | Course Project - Automation in Manufacturing Feb 2022 - May 2022

Conducted a study on the production of oxygen using lunar regolith and the feasibility of setting up a factory on the moon.

- Designed the required space factory components in **Fusion 360**, addressing material handling systems and energy requirements for low-gravity operations.
- Analyzed the **manufacturing metrics and the economic viability** of setting up such a facility for future moon missions.

Social Impact

- **Coordinator of UpSkill | Shaastra 2021**
  - Worked in a team of 8 to promote computational thinking in schools impacting over **7000 school teachers** across India.
  - **Moderated a virtual Panel Discussion** on Computational thinking with panellists from Google, Microsoft and ACM.
  - Solely responsible for striking a deal with Codingal, an ed-tech startup that served as the curriculum partner of UpSkill.

Teaching and Extracurricular Activites

- Conducted lab sessions as the **Teaching Assistant** for the **graduate-level course - ME5281 Machine Design Lab.**
- Served as a **mentor to six freshmen** at IIT Madras, facilitating their academic and co-curricular adaptation.
- Helped plan and organise large-scale games and ice breakers for the crowd at Saarang 2020, attended by 70,000+.
- **Sports**
  - **Athletics**: Awarded a 100m silver medal in a state level competition by Anju Bobby George (ex-Indian Olympic athlete).
  - **Field Hockey**: Part of the winning team in the Intra IIT Madras Hockey Tournament 2022.